

philosophy,—one which probably never can be more than partially resolved. Still, even a cursory and superficial examination of a few particular cases seems to show that, far from being a mere arbitrary assumption, it is at least a reasonable and probable account of what really does take place in nature, in many large classes of errors of observations. The history of practical astronomy, in particular, seems to prove that, whatever doubt may be entertained of its exactness as applied to the errors of rude and primitive observers, we may safely accept it in the case of the refined and delicate observations of modern astronomers.

It would be scarcely possible in this Abstract to convey any clear idea of the mathematical analysis employed in reducing the above hypothesis to calculation. It will suffice to remark that, whereas in the processes given by Laplace and Poisson, when applied to the problem before us, the elementary component errors are at first supposed of finite magnitude, and finite in number, and the results are afterwards modified for the supposition that the magnitude of the errors becomes infinitesimal and their number infinite; much simplicity is gained in this Paper by making these suppositions at the commencement. Also, instead of taking a simultaneous view of all the elementary errors, as affecting the actual or resultant error, the latter is considered as produced by the superposition of some one of the elementary errors upon the error produced by the combination of all the others. We are thus led to examine the infinitesimal change produced in a given finite error, as expressed by a given function, by the superposition of a new infinitesimal error; and from the analytical expression arrived at, it is shown how to find the form of the function of error resulting from the combination of an infinite number of given infinitesimal errors. This form is found to be altogether independent of the nature or laws of the component errors. If we assume the following data as known, viz.

m = sum of the mean values of the component errors,

h = sum of the mean values of the squares of component errors,

i = sum of squares of the mean values of component errors,

it is proved that the probability of the actual resulting error being found to lie between x and $x + dx$ is

$$\frac{1}{\sqrt{2\pi(h-i)}} e^{-\frac{(x-m)^2}{2(h-i)}} dx.$$

This result will be found to agree with Poisson's.

April 29, 1869.

Lieut.-General SABINE, President, in the Chair.

Pursuant to notice given at the last Meeting, Alphonse DeCandolle, of Geneva; Charles Eugène Delaunay, of Paris; and Louis Pasteur, of Paris, were ballotted for and elected Foreign Members of the Society.

The following communications were read:—

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I. "On a certain Excretion of Carbonic Acid by Living Plants."

By J. BROUGHTON, B.Sc., F.C.S., Chemist to the Cinchona Plantations of the Madras Government. Communicated by J. D. HOOKER, M.D., F.R.S. Received March 31, 1869.

[Abstract.]

While the author was engaged in some experimental determinations of the changes that take place in the composition of the Cinchona barks after being taken from the tree, he noticed a somewhat singular circumstance, which induced him to institute a series of experiments, by which he discovered that the various parts of living plants excrete carbonic acid, not only in their normal condition, but after they have been deprived for days together of all access of oxygen. The experiments were mostly made on cut portions of the plants; but experiments were also made, for control, on plants as they actually grow. The deprivation of oxygen was effected sometimes by Sprengel's air-pump, sometimes by substituting for air an atmosphere of hydrogen or nitrogen; while comparative experiments were made on plants supplied with air that had been freed from carbonic acid. The main conclusions to which he was led are those enunciated by the author:—

1st. That nearly all parts of growing plants evolve carbonic acid in considerable quantities, quite independently of direct oxidation.

2nd. That this evolution is connected with the life of the plant.

3rd. That it is due to two causes, namely, to previous oxidation, resulting after a lapse of time in the production of carbonic acid, and to the separation of carbonic acid from the proximate principles of the plant while undergoing the chemical changes incident to plant-growth.

II. "On the Causes of the Loss of the Iron-built Sailing-ship 'Glenorchy.'" By ARCHIBALD SMITH, Esq., M.A., LL.D., F.R.S. Received April 15, 1869.

When the loss of an iron-built vessel has been caused by an error in the direction of her course by dead reckoning, as derived from her course by compass, it is a question of scientific interest whether the error has or has not arisen from an error in the assumed deviation of the compass. By careful consideration of all the circumstances of the case, and by piecing together the generally scanty fragments of information which can be obtained as to the magnetic state of the ship, a probable or certain answer to this question may be given more frequently than might be supposed possible by those who do not know how perfectly definite and well ascertained the laws of the deviation of the compass are, how small is the number of quantities involved which are peculiar to each particular ship, and from what apparently slight indications an approximate estimate of the numerical values of these quantities can be made.